MINERALOGY AND PETROGRAPHY.[1]

The Eruptive Rocks of Cape Bonita, Cal.—The eruptive rocks forming the main mass of Cape Bonita, the northern Cape separating San Francisco from the Pacific Ocean, are spherical basalts and diabases, in addition to basic tuffs. The basalt is remarkable for the great spheroidal masses that characterise it. In many places the entire rock-mass is a closely packed aggregate of large bolster-like bodies, whose cross-section is approximately circular. These consist of a compact amygdaloidal rock, made up of lath-shaped plagioclases lying in a glassy base. In all cases the rock of the spheroids is much altered, and is of the same composition in the interiors as on the peripheries of the bodies. In a few cases augite may be detected as small grains that are younger than the plagioclases, but the rock on the whole is very uniform in character. The diabase is more interesting petrographically. It is younger than the basalt and has intruded this rock. Besides the usual constituents of diabase it contains iddingsite in large, rounded, idiomorphic forms. The augite varies in color from nearly colorless to a deep violet red, the latter varieties possessing a pleochroism in yellowish green and violet red tints. A qualitative test showed the presence of titanium. Sometimes the augites of different colors are intergrown, when they are optically continuous, and not infrequently the mineral is intergrown with brown hornblende. The outlines of the iddingsite are strongly suggestive of olivine. It was one of the earliest separations from the magma, being included in the augite and in the hornblende. Its own enclosures are magnetite and chromite or picotite. In some phases of the rock both green and brown hornblende are present. Both of these are regarded as original and as of the same age as the augite, for they are frequently intergrown with the pyroxene as well as with each other. In one place the diabase is variolitic, with variolites composed of tiny brushes and crystallites of various minerals, lying in a microlitic diabasic groundmass. Iddingsite occurs both in the groundmass and in the varioles. The pyroclastic rock associated with the basalt and the diabase is probably an ash of a basaltic character. Some of its component fragments resemble closely the material of the spheroidal rock. Analyses of the rocks discussed are given by Mr. Ransome,[2] in a recent number of the University of California Bulletin.

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] Bull. Geol. Dept. Univ. Cal., Vol. 1, p. 71.

Lamprophyres near the Shap Granite Mass.—Near the Shap granite in the North of England there are numerous dykes of minette and kersantite that are believed by Harker[3] to be the dyke facies of the granite, just as fourchite and ouachitite are regarded by Rosenbusch as dyke facies of eleolite-syenite. These lamprophyres contain many rounded blebs of quartz and corroded crystals of orthoclase, both of which appear to owe their present shapes to resorption processes, since both minerals are surrounded by resorption borders. The dyke rocks are thought to be genetically connected with the granite because of their age and distribution, and because of the fact that they contain the quartz and orthoclase above referred to, and also sphene, which is a characteristic component of the granite. A study of the literature of the lamprophyres shows that these rocks are often associated with granites, and hence Harker believes that the group may be discovered to be genetically related to this group of plutonic rocks. A special feature of the lamprophyres pointed out by the author is that while the total alkalies in them is about equal in amount to the sum of the alkalies in the associated granite, the potash in the former always bears a larger ratio to the soda than it does in the latter rock. It is suggested that the granite and the lamprophyres are portions of the same magma that became differentiated by gravity. From the supernatant layer, which was acid, quartz and orthoclase separated and then settled down into the lower basic portions of the mass. These were then partially dissolved, the solution of the orthoclase accounting for the large proportion of potash in the lamprophyres. In a later paper the author[4] argues against the view of Diller and Iddings that the sporadic quartzes in certain basalts and other basic rocks are the result of crystallization under other than the normal conditions. He thinks that in all these cases the quartz may have originated as outlined above.

The Geology of Conanicut Island, R. I.—The carboniferous phyllites of Conanicut Island in Narragansett Bay are cut by a mass of coarse-grained muscovite granite porphyry that has produced contact effects in the surrounding sedmentaries.[5] The granite, which exhibits many evidences of its intrusive nature, was regarded by Dale[6] as a metamorposed clastic rock, forming the lowest member of the bedded series at this place. The phyllites near the contact with the granites

[3] Geol. Magazine, 1892, IX, p. 199.

[4] Ib. IX, p. 485.

[5] L. V. Pirsson. Amer. Jour. Sci., 1893, XLVI, p. 363.

[6] Proc. Bos. Soc. Nat. Hist., 1883, XXII, p. 179.

have been changed into hornstones and knotty schists. Besides the granites the only other intrusives cutting the slates are two dykes of minette, both of which show the effects of pressure. One of the dykes consists essentially of orthoclase and two generations of biotite. It contains also apatite and zircon and large quantities of plagioclase and calcite. In the squeezed phase of the rock the biotite has been changed to chlorite. The material of the second dyke differs from that of the first one, only in that it has been more thoroughly squeezed and consequently has suffered greater alteration.

Petrographical News.—Sears[7] finds that the porphyritic feldspar in the rock from Marblehead Neck, Mass., called by Wadsworth[8] trachyte, are anorthoclases, and that much of the feldspar of its groundmass is of the same nature, consequently the rock is a keratophyre. Analyses of the rock and of one of its phenocrysts follow:

	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	CaO	MgO	K_2O	Na_2O	P_2O_5	H_2O
Rock	70.23	.03(?)	15.00	1.99		.24	.33	.38	4.99	4.98	.06	2.19
Felds.	65.66		20.05	tr.	tr.	.13	.67	.18	6.98	6.56		.41

The report of the State Geological Board of Michigan[9] contains brief microscopic descriptions of certain eruptive, sedimentary and schistose rocks of the Upper Peninsula by Drs. Patton and Lane. Among the former are described granites, syenites, serpentine and lamprophyres. Among the sedimentaries graywackes, quartzites and slates, and, among the foliated rocks, amphibolites and hornblende schists. The amphibolites are principally altered diabases. Quartz diabases are mentioned by Lane as existing in dykes cutting graywackes and slates that are sometimes changed on the contact into spilosites, and quartzites that are altered near the intrusive into Lydian stone. Dr. Wadsworth, in the same volume, gives an outline scheme of his classification of rocks (eruptive and sedimentary), the principles of which were first ennunciated at length in his Lithological Studies.[10]

Graeff[11] has found, in an old hand specimen of tephrite from Horberig in the Kaiserstuhl, a holocrystalline basic concretion with a structure approaching that of theralite.

[7] Bull. Mus. Comp. Zool., Vol. XVI, p. 167.
[8] Proc. Bost. Soc. Nat. Hist., XXI, p. 288.
[9] Rep. State Board of Geol. Survey for 1891-92. Lansing, 1893.
[10] Mem. Mus. Comp. Zool., 1884, XI.
[11] Versamm. Oberrh. Geol. Ver. Ber., XXVI, 1893.

A modification of the microchemical method for determining iron in minerals is given by Lemberg.[12] It consists in producing Turnbull's blue from the ferrous sulphide precipitated on the mineral in question.

Alurgite and Violan from St. Marcel.—Among the minerals from the Manganese mines of St. Marcel, Piedmont, *alurgite* and *violan* haʌe always excited considerable interest because of their rich color and their variety. The alurgite was described by Breithaupt as a deep red mica. Penfield[13] has recently obtained a sufficient quantity of the material for study. He describes it as monoclinic in crystallization and micaceous in habit. Its cleavage plates are flexible and somewhat elastic. It is biaxial with $2\ E_{na} = 56° \ 32'$ (average) and its dispersion is $\varsigma > v$, but often plates show a uniaxial optical figure, due, as the author supposes, to twinning. The mica is one of the first order, and in spite of its dark color, its pleochroism is very slight. Density = 2.835 —2.849. H = 3. Composition:

SiO_2	Al_2O_3	Fe_2O_3	Mn_2O_3	MnO	MgO	K_2O	Na_2O	H_2O	Total
53.22	21.19	1.22	.87	.18	6.02	11.20	.34	5.75	= 99.99

In the formula $H\ R_2\ (Al\ OH)\ Al\ Si_4O_{12}$, R = K and Mg OH. Alurgite is thus a distinct species, which is more nearly allied to lepidolite than to muscovite, although it is a potash mica. The alurgite is associated with a jadeite composed largely of a soda-rich pyroxene that is pleochroic in pale rose and pale blue tints. Its density is 3.257—3.382, and composition (mean of two analyses):

SiO_2	Al_2O_3	Fe_2O_3	Mn_2O_3	MnO	MgO	Ca_2O	Na_2O	K_2O	Ign	Total
54.59	9.74	11.99	1.06	.58	5.03	7.24	9.32	.24	.37	=100.16

corresponding to $Na\ R(SiO_3)_2$ in which R = Al, Fe''', Mn'''. The mineral occupies about the same position in the pyroxene group as glaucophane does among the amphiboles. In composition it agrees most closely with the chloromelanite from Mexico analysed by Damour.[14]

For purposes of comparison with this pyroxene, the author analysed a specimen of violan whose density was 3.272 — 3.237, with this result.

SiO_2	Al_2O_3	Fe_2O_3	Mn_2O_3	MnO	MgO	CaO	Mn_2O	K_2O	Ign	Total
53.94	1.00	.86	.88	.36	16.63	23.80	1.22	.05	.66	= 99.44

The figures indicate a mixture of the diopside, jadeite and acmite mole-

[12] Zeits d. deuts. geol. Ges., 1892, p. 823.
[13] S. L. Penfield. Amer. Jour. Sci. XLVI, p. 288.
[14] Bull. Soc. Min. d. Franc, IV, 1881, p. 157. Cf. also foot-note No. 30.

cules in the proportions 90.8 : 4.1 : 2.4, with the addition of 2.7% of the molecule Na Mn $(SiO_3)_2$. The mineral is essentially a blue variety of diopside, differing from the anthochroite of Igelström[15] and from the blue pyroxene of Merrill and Packard.[16]

Zonal Plagioclase.—Herz[17] has shown by a study of the position of axial planes in successive zones of zonal plagioclase, and by the values of the respective cleavage angles, that the zonal banding in this mineral is due to the concentric growth of envelopes of different composition. The axial planes and the cleavage angles always correspond with the extinction angles in the corresponding band. It had been suggested by Grosser that the regular decrease in the extinction of the shells of a zonal plagioclase is due to difference in the orientation of the successive envelopes and not to a difference in their chemical composition. Herz's work proves conclusively that the decrease in the value of the extinction is not due to differences in orientation of the same chemical substance.

Hercynite in Gabbro.—Small octahedra and large irregular masses of the green spinel hercynite occur in an altered gabbro at Le-Prese, in the Valtellina, Switzerland. According to Linck,[18] it is found as irregular granular masses within the rock, and as small octahedral crystals enclosed in its plagioclase and associated with corundum sillimanite and biotite. The spinel includes small quantities of biotite, small plates of ilmenite, resembling the plates in hypersthene, a little pyrite, etc. An analysis of tolerably pure material yielded :

SiO_2	Al_2O_3	Fe_2O_3	MgO	FeO		Total
1.59	59.62	3.10	9.38	25.30	=	98.99

which corresponds to (Fe Mg) Al_2O_4 in which Fe : Mg = 3 : 2.

Optical Constants of Topaz.—Four Japanese topaz crystals and one crystal of the same mineral from New South Wales are described by Hahn,[19] and some of the optical constants of the former have been determined. One of the crystals from Otamjama near

15 AMERICAN NATURALIST, 1890, p. 74.

16 Ib., 1892. p. 848.

17 Min. u. Petrog. Mitth. XIII, p. 341.

18 Sitzb. d. Kön-preuss. Akad. d. Wiss. zu Berlin. Phys.-Math.-Classe., 1893, p. 47.

19 Zeits. f. Kryst., XXI, p. 334.

Kioto, has the following refractive indices and optical angles for yellow light: $\beta = 1.6182$, $\gamma = 1.6252$, $2 V = 62° 40'$, $2 E = 114° 31'$. The crystal from New South Wales has $2 E = 113° 18'$.

Mineralogical News.—Stöver announces the discovery of fine *celestites* in the Jurassic schists of Brousseval in France. Their axial ratio is .7803 : 1 : 1.2826, and index of refraction for sodium light = 1.6235. The crystals are one centimeter in length, and are elongated parallel to $\breve{a}$. Similarly habited crystals occur also in the marl of Ville-sur-Sault. The axial ratio of these is .7806 : 1 : 1.2797, and density = 3.991.

Rheineck[20] has made another attempt to calculate from the published analyses general formulas for *tourmaline* that will not only represent the composition of all varieties of the mineral, but which will also express its relationship with micas. He concludes that there are two alkaline varieties, viz.: $Al_4\, Si_3\, B\, H_3O_{15}$ and $Al_4\, Si_3\, B_2\, H_4\, O_{17}$, and two magnesium varieties, $Al_4\, Si_5\, B_2\, Mg_4O_{25}$ and $Al_4\, Si_5\, B_2\, Mg_3\, O_{22}$, by whose intermingling all other varieties are formed.

Several crystallographic observations of Baumhauer[21] are of interest. A yellow *diopside* from the Canton of Graubünden (Grisons), Switzerland, has an axial ratio $a : b : c = 1.0918 : 1 : .5879$, with $\beta = 74° 12' 15''$. *Binnite* crystals from Infeld in the Binnenthal are certainly tetartohedrally hemihedral, as the author has succeeded in finding upon them, well-developed, the planes $\frac{0}{2}$ and $\frac{202}{2}$.

Oebbecke[22] mentions the occurrence of *topaz* with feldspar, apatite, tourmaline, fluorite, etc, at Epprechtstein and its existence in the granite of the Gregnitzgrund in the Fichtelgebirge.

The *arsenopyrite* of Weiler in Alsace occurs in an arkose from which Scherer[23] has obtained crystals sufficiently large for measurement and analysis. These crystals are prismatic in habit, and have an axial ratio $a : b : c = .6734 : 1 : 1.1847$. A mean of two analyses gave figures corresponding to Fe : S : As = 1 : .9933 : .9751.

Mallard[24] has come into the possession of some beautiful little crystals of *periclase* that were found implanted on a white compact crust produced in the culcination of some of the Stassfurt materials.

Several twins of *aragonite* from the tunnel of Neussargues in Cantal,

[20] Zeits. f. Kryst., XXII, p. 52.
[21] Ib., XXI, p. 200.
[22] Ib., XXII, p. 273.
[23] Ib., XXII, p. 62.
[24] Bull. Soc. Franc. Min., XVI, p. 18.

France, are reported by Gonnard[25], and some fine crystals of *pinite*[26] from Issertaux, near St. Pardoux in the Auvergne.

Miscellaneous.—In his development of the theory of the constitution of the *micas*, Clarke[27] has reached the problem of the lithium members of the group. This he solves by supposing lepidolite to be an admixture of the simple molecules $Al\ F_2\ Si_3\ O_8\ R_3'$, in which R' is principally lithium, and $Al_3\ (SiO_4)_3\ R_3'$, in which R_3' may be either K_2H or KH_2.

Retgers[28] suggests molten phosphorus and a solution of phosphorus in CS_2 as media for use in determining the indices of refraction in highly refracting substances. A tiny fragment of the phosphorus may be melted between two object-glasses, when it spreads as a thin sheet between them, and, upon cooling, remains transparent. Its refractive index is 2.144. That of a saturated solution of the substance in CS_2 is 1.95.

Some time ago, Damour[29] suggested the name *chloromelanite* for one of the varieties of jade found in ancient implements. He discovers now that the material contains garnets and pyroxene. It thus resembles the rock eclogite. The pyroxene from a Mexican specimen is composed as follows:

SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	Na_2O		Total	Sp. Gr.
56.57	17.21	8.86	4.44	2.12	10.70	=	99.90	3.37

Nordenskjöld[30] has begun the study of snow crystals. The first contribution to his discussion is a series of handsome photographs of a large variety of flakes, including prismatic, stellar and other forms some of which contained liquid enclosures at the time of their fall.

[25] Ib., XVI, p. 10.
[26] Ib., XVI, p. 16.
[27] Bull. Am. Chem. Soc., XV, May, 1893.
[28] Neues Jahrb. f. Min., etc., 1893, II, p. 130.
[29] Bull. Soc. Franc. Min., XVI, p. 57. Cf. also foot-note No. 14.
[30] Ib., XVI, p. 59.